MOPITT during INTEX

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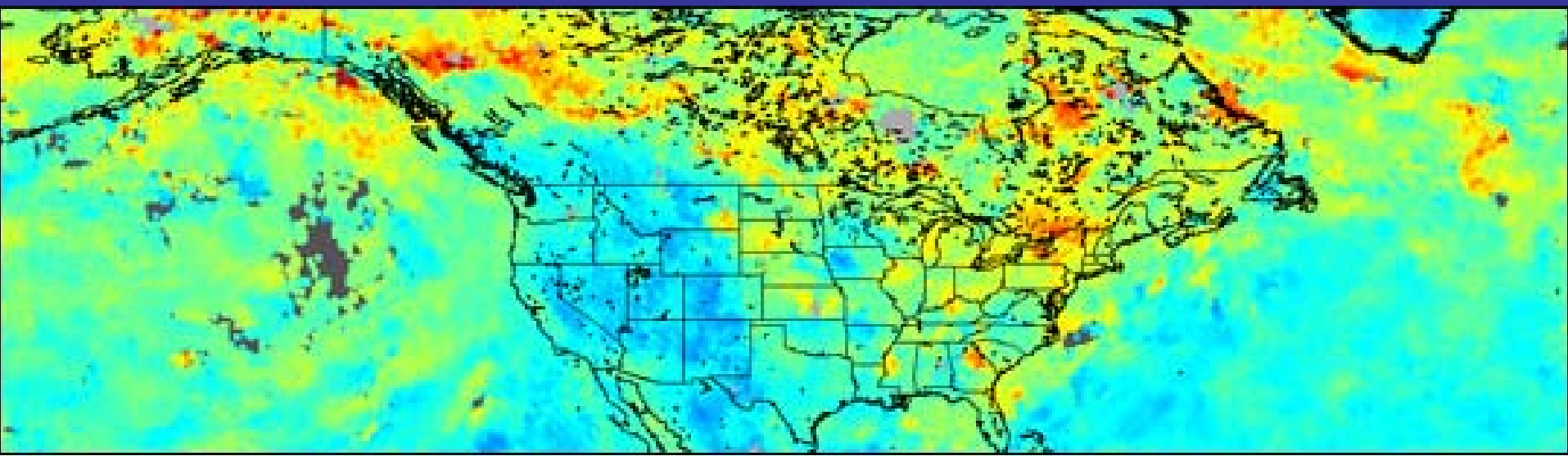
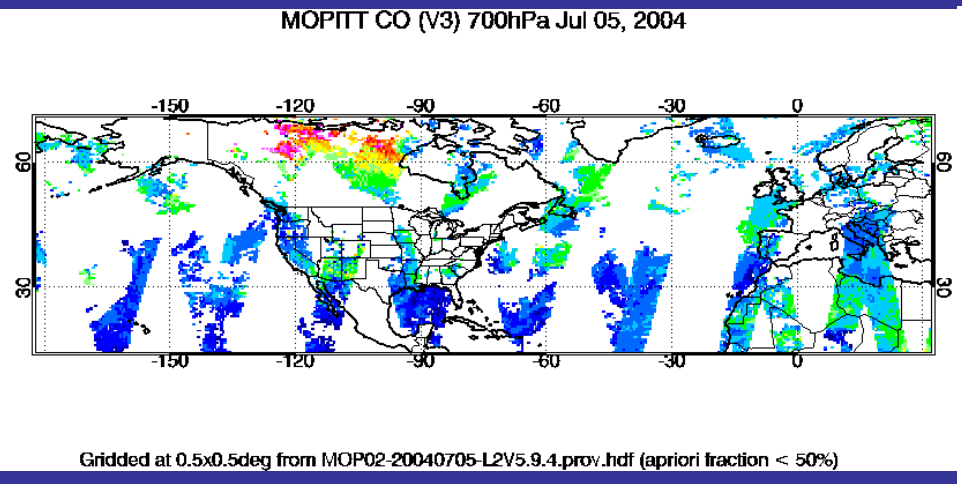
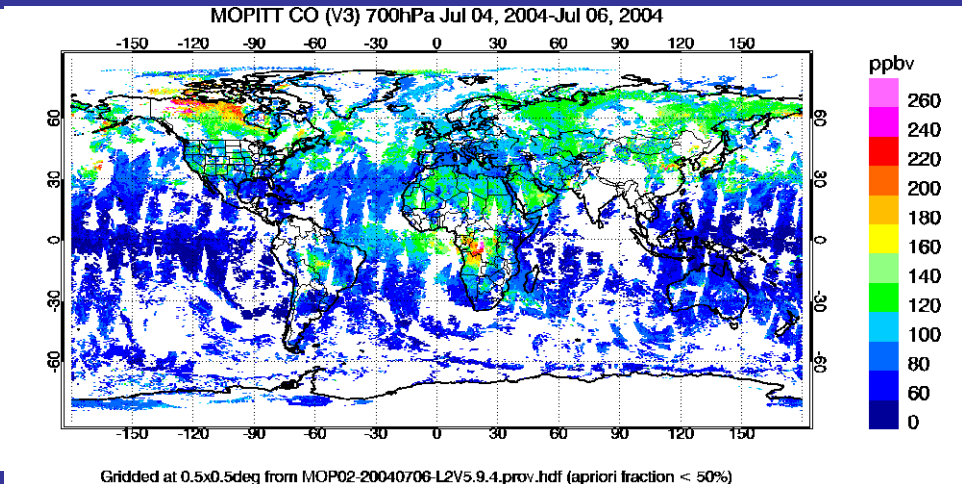


Near-Real-Time MOPITT Data

http://www.eos.ucar.edu/mopitt

- Expedited data for N. America/N. Atlantic provided within ~9 h of sampling - used for flight planning
- Rapid Response data for globe available in ~1 day
- HDF and text format files were made available on MOPITT website, along with images
- All images and data files on website have been updated with final retrievals





Final MOPITT Data

- Final retrievals are processed with the MODIS cloud mask (usually within a week) and delivered to the Langley DAAC
- All data on the DAAC is available for public use (see MOPITT website for info: www.eos.ucar.edu/mopitt)
- Gridded data ("Level 3") will be available from the DAAC soon
  - 1° x 1° grid for each retrieval level
  - Day and night separate, averaging kernels included
  - Daily and monthly averages
- Data files suitable for posting on the INTEX data archive will be created
- Please contact us if you need assistance

MOPITT Validation

DC8 sampled 10 profiles coincident with MOPITT overpasses:

- July 8 (Flt 5) - N. Illinois (42N, 270E)
- July 15 (Flt 8) - N. Wisconsin (46N, 270E)
- July 22 (Flt 11) - Gulf of Maine (43N, 290E)
- July 25 (Flt 12) - off E. Florida (28N, 281E)
- July 31 (Flt 14) - off New England coast (41N, 294E)
- Aug 2 (Flt 15) - Gulf of St. Lawrence (49N, 298E)
- Aug 6 (Flt 16) - Tennessee (36N, 276E)
- Aug 7 (Flt 17) - Gulf of Maine (42N, 292E)
- Aug 11 (Flt 18) - off VA coast (37N, 295E)
- Aug 13 (Flt 19) - off Gulf coast (30N, 271E)

DACOM CO data (G. Sachse) used for all flights, except 7/31, where DACOM was available only below 3km; UCI can data used above

MOPITT CO Retrievals

MOPITT CO retrievals are determined by maximum likelihood (optimal estimation), incorporating *a priori* information.

The retrieved profile **x'** can be expressed as a linear combination of the true profile **x** and the *a priori* profile $\mathbf{x_a}$.

$$\mathbf{x' = A\,x + (I-A)\,x_a}$$

The Averaging Kernel **A** represents the **measurement sensitivity** to the true profile. **I** is the identity matrix.

Averaging kernels depend on the contrast between air and surface temperature and surface emissivity.

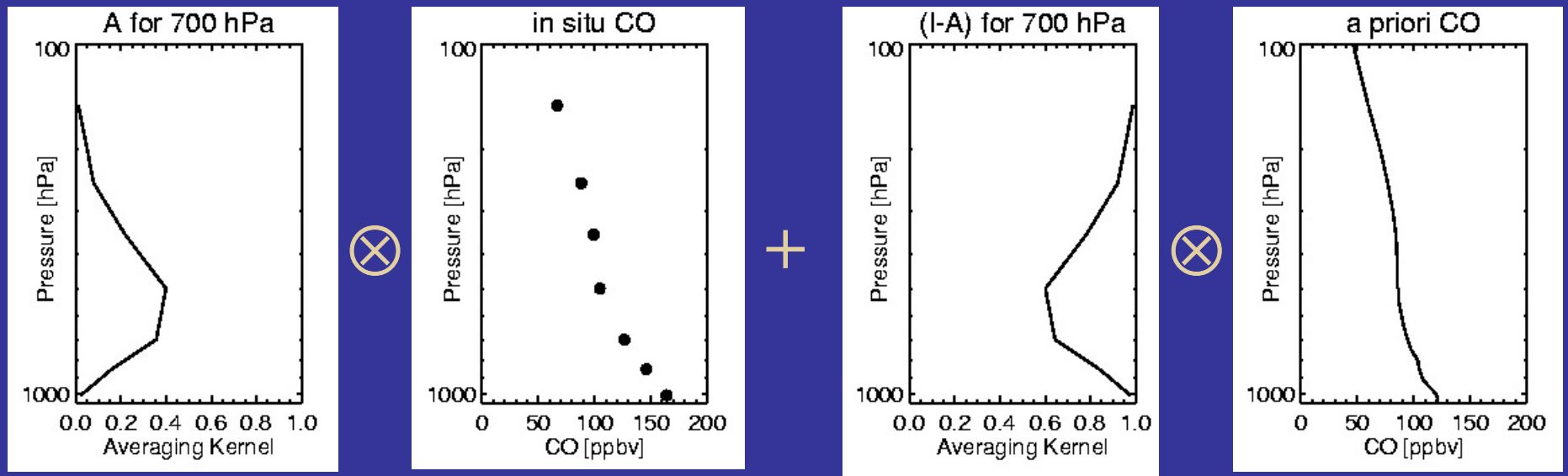
Transformation of *in situ* Profiles

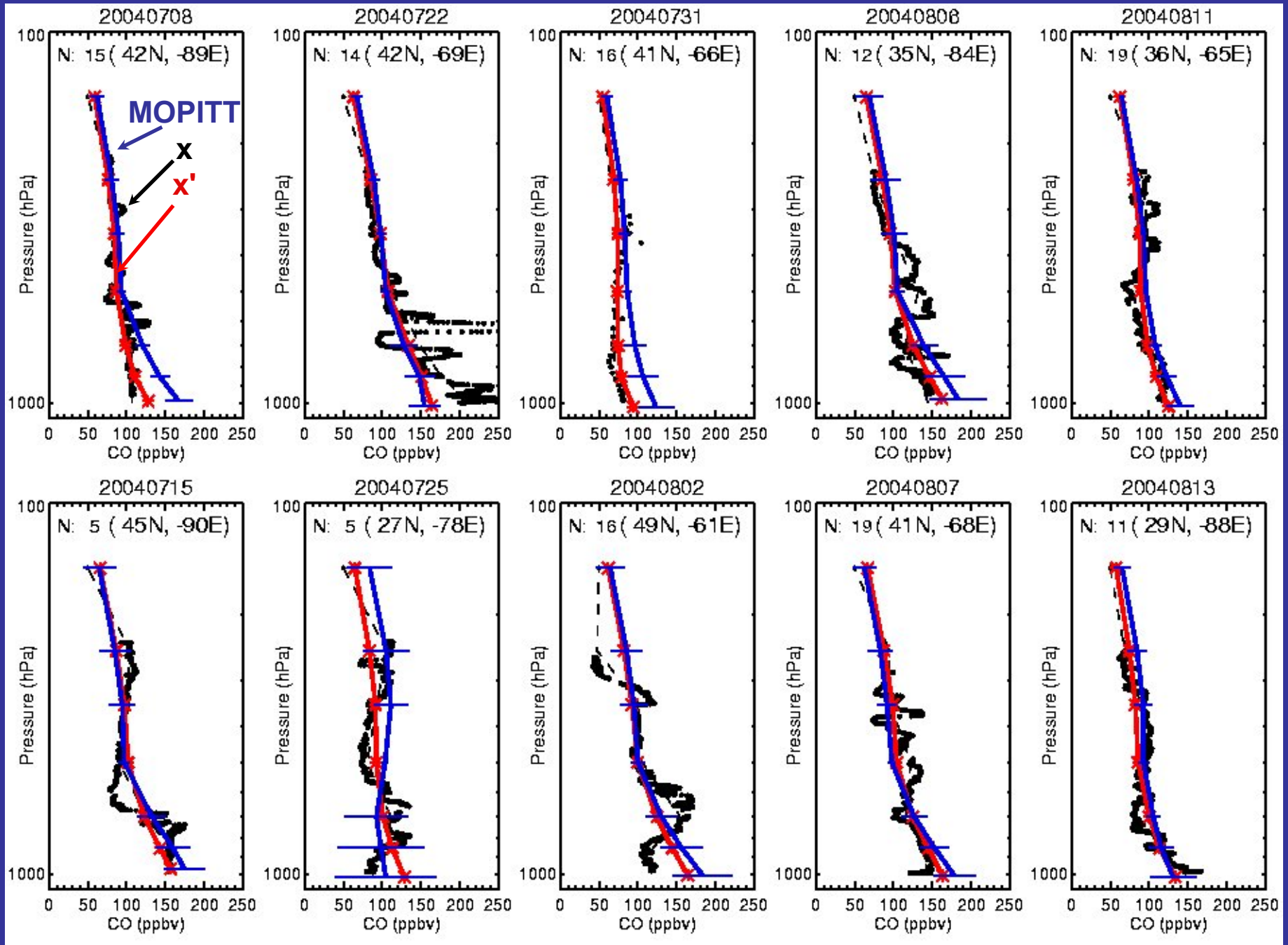
The averaging kernels and a priori CO profile are used to calculate **x'** from in situ CO (**x**):

$$\mathbf{x' = A\,x + (I-A)\,x_a}$$

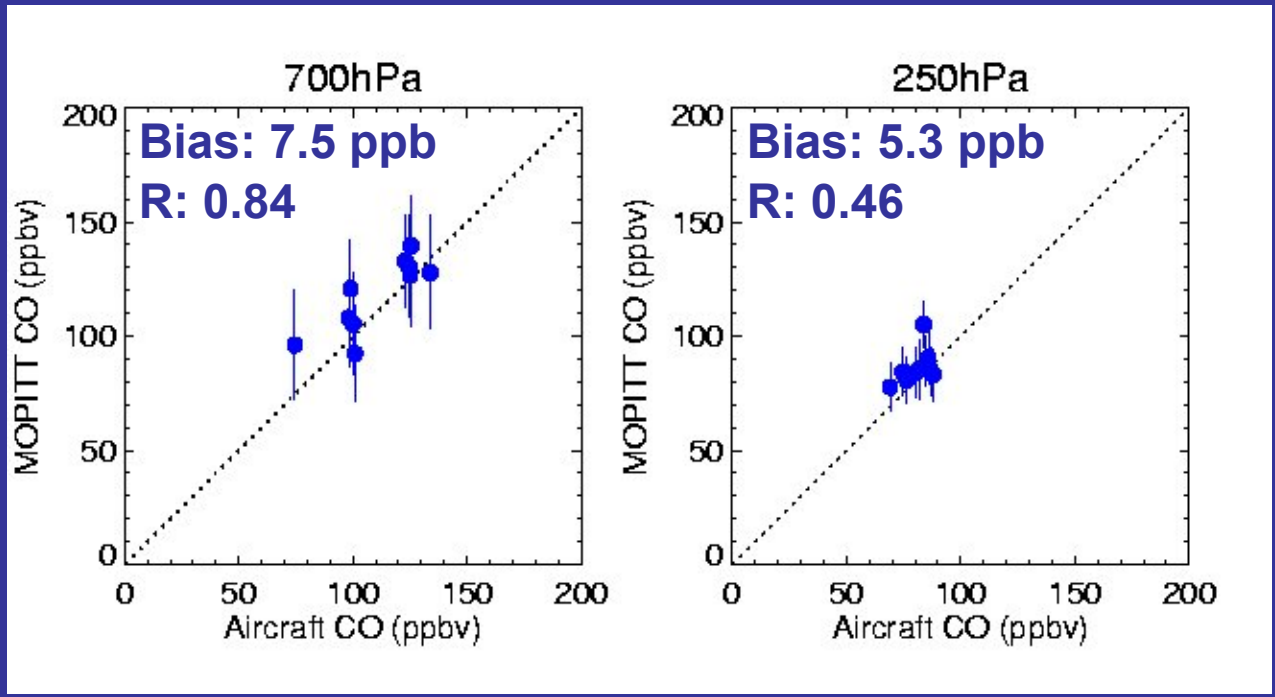
For example, **x'**(700 hPa) =

$\mathbf{A_{700}}$ $\mathbf{x}$ $+$ $\mathbf{(I-A_{700})}$ $\mathbf{x_a}$




20040708
N: 15 (42N, -89E)
MOPITT
x
x'
20040722
N: 14 (42N, -69E)
20040731
N: 16 (41N, -66E)
20040806
N: 12 (35N, -84E)
20040811
N: 19 (36N, -65E)
20040715
N: 5 (45N, -90E)
20040725
N: 5 (27N, -78E)
20040802
N: 16 (49N, -61E)
20040807
N: 19 (41N, -68E)
20040813
N: 11 (29N, -88E)
Pressure (hPa)
100
1000
0 50 100 150 200 250
CO (ppbv)

Validation Summary



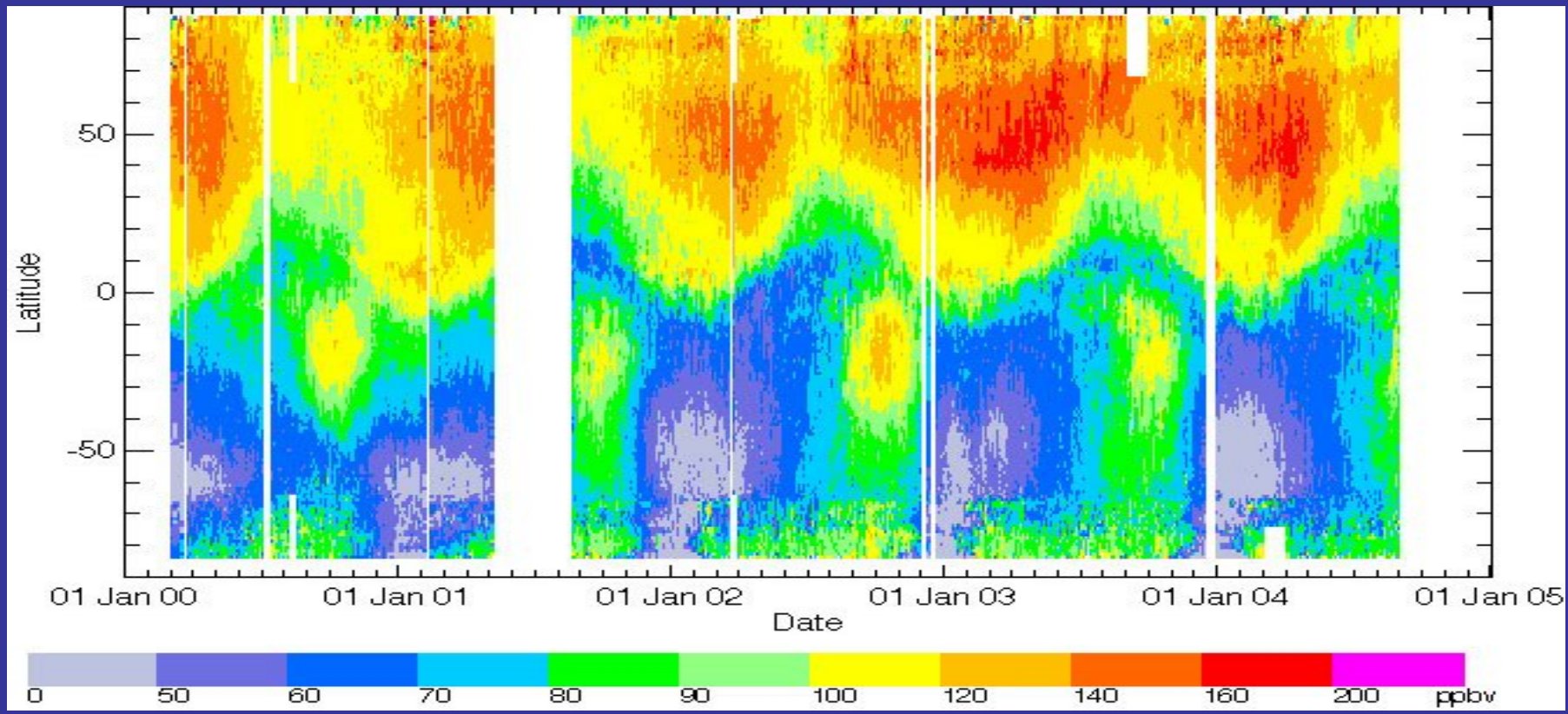
For each overpass use MOPITT pixels within 0.5 deg of average lat/lon of profile

Number of pixels varies (5-19)

On-going work: identify cause of bias and variability (cloud interference?)

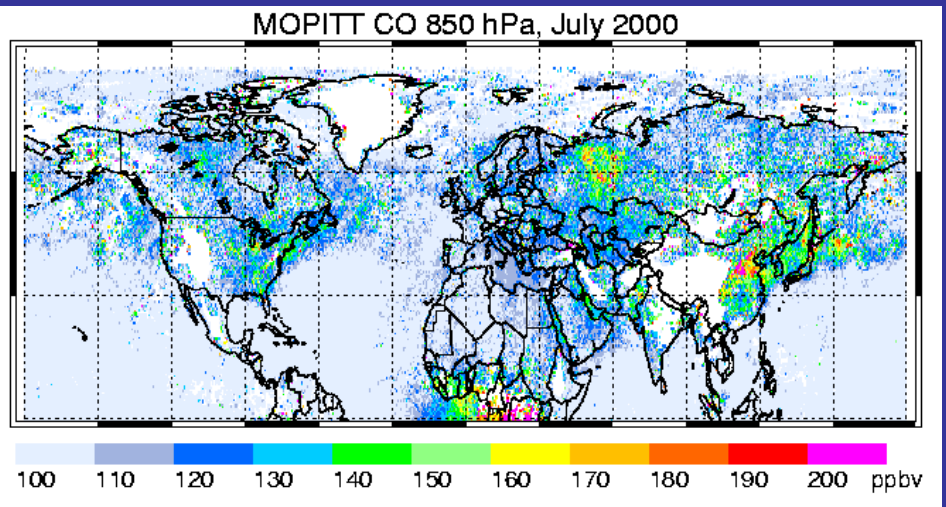
Zonal Mean Variability: 2000-2004

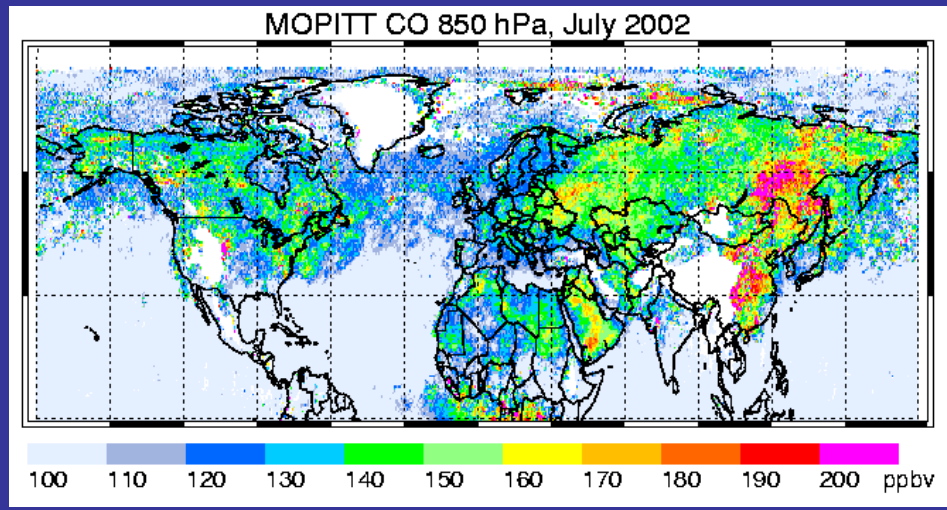
MOPITT CO 700 hPa

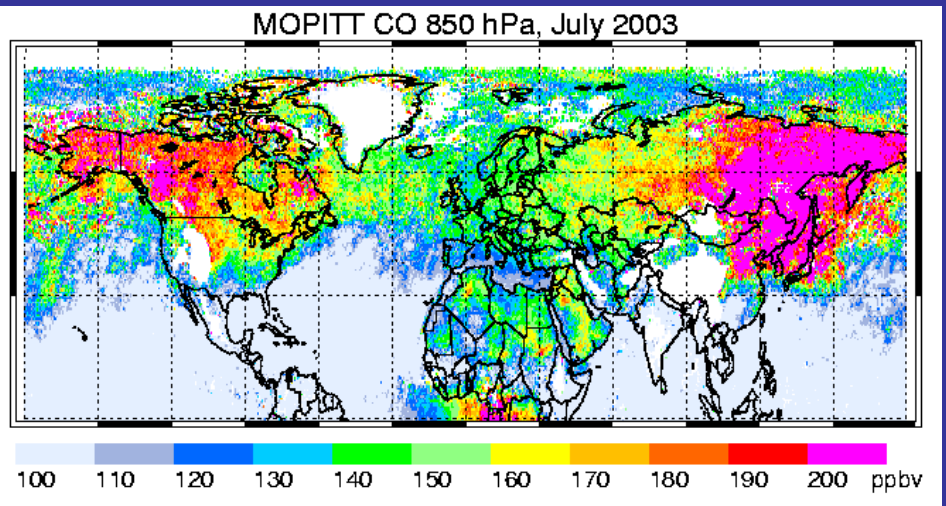


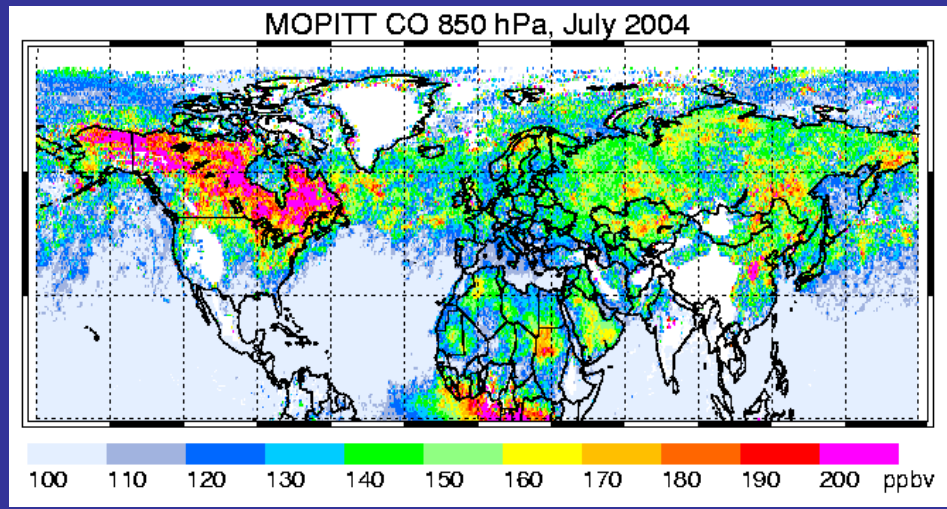
The peak of the Southern hemisphere biomass burning maximum occurs each year in September-October and has variable intensity
The Northern hemisphere winter maximum occurs in March-April
Apparent increase from 2000 to 2003
The 2002-3 winter maximum was particularly intense and started early

MOPITT for previous Julys



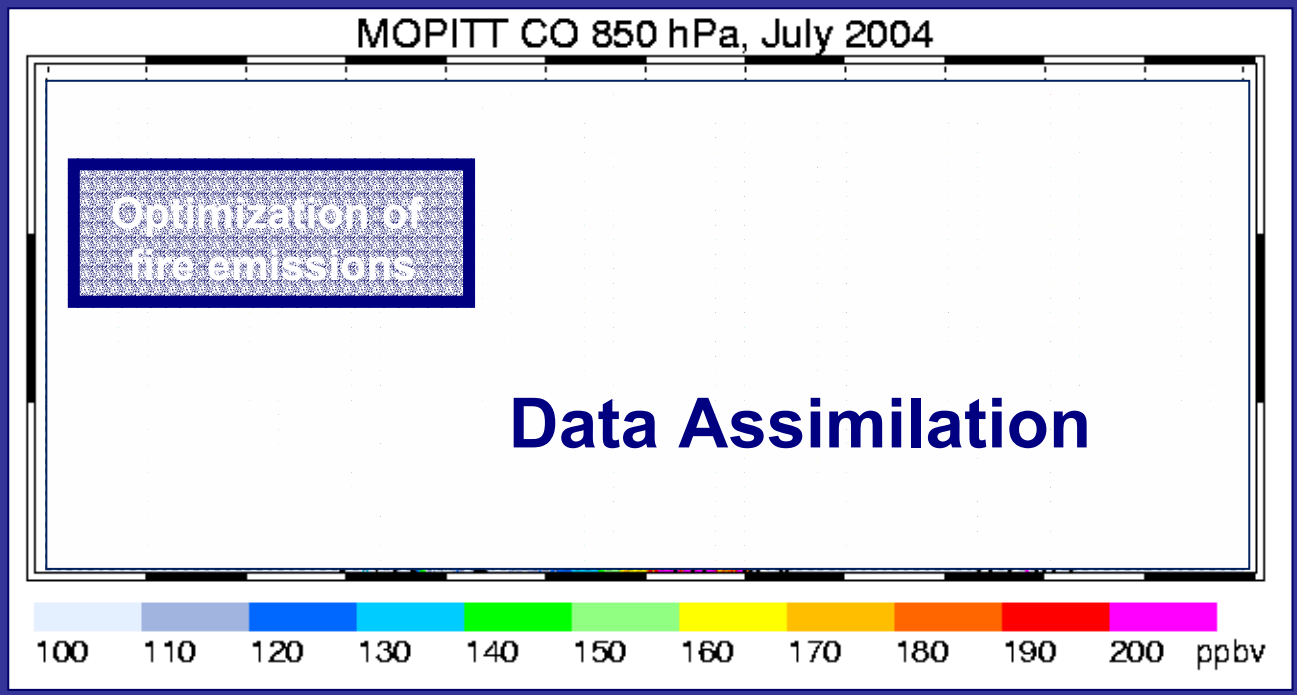






Inverse Modeling of CO Fire Emissions

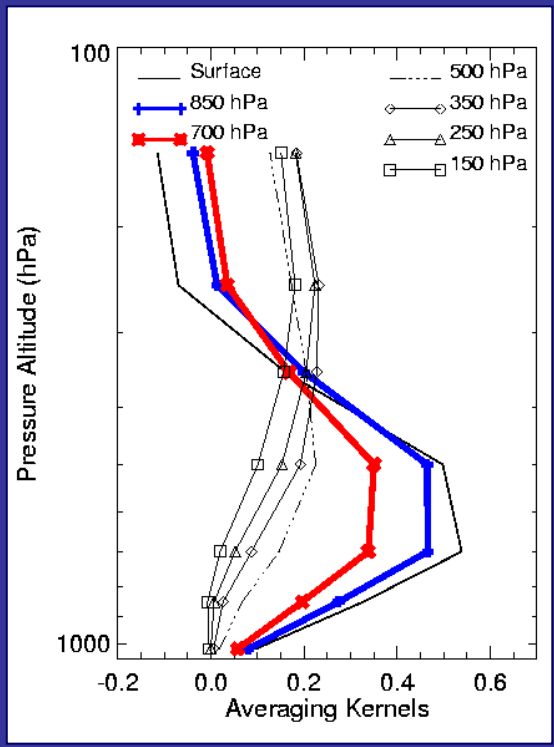
Gabriele Pfister et al.



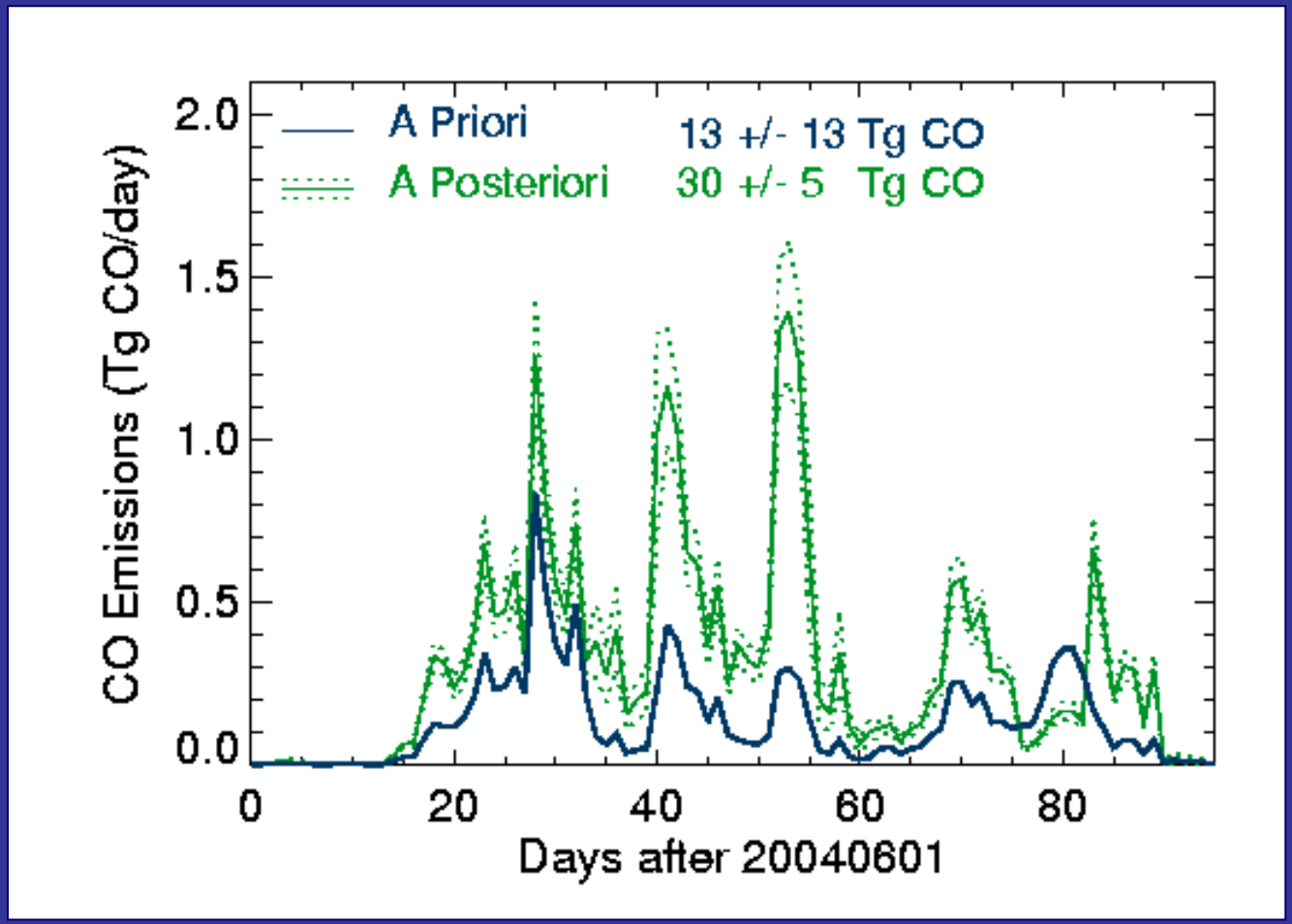
- Fire emissions optimized over Alaska and Canada
- Assimilation of MOPITT into MOZART accounts for errors in emissions for rest of globe
- Other sources within fire regions (anthropogenic, methane and NMHC oxidation) are assumed small or well known

Methodology

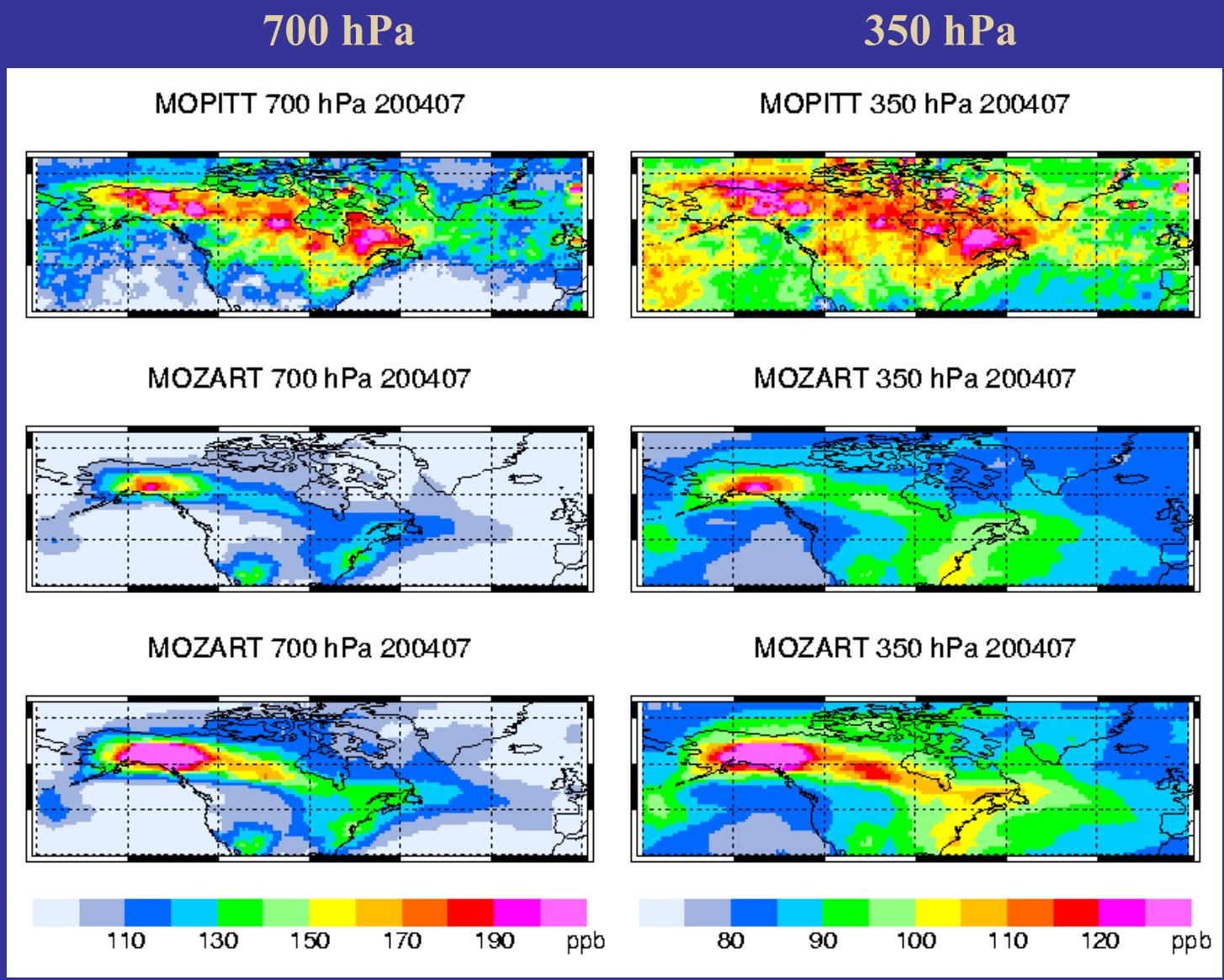
- **A Priori Emissions of Wildfires**
  - based on MODIS Fire Counts (Christine Wiedinmyer, NCAR)
  - daily for June – September 2004
- **Forward Model - MOZART**
  - www.acd.ucar.edu/science/gctm/mozart
  - 2.8° x 2.8°, 28 vertical levels, met. fields from NCEP
- **Assimilation Scheme**
  - MOPITT CO assimilated into MOZART (Lamarque et al., 1999)
- **CO Measurements – MOPITT**
  - retrievals @ 850 hPa and 700 hPa
  - retrieval a priori fraction < 50%
- **Inverse Modeling Scheme**
  - Bayesian Inverse Technique (Rodgers, 2000)



A Priori and A Posteriori Emissions



Evaluation – July 2004



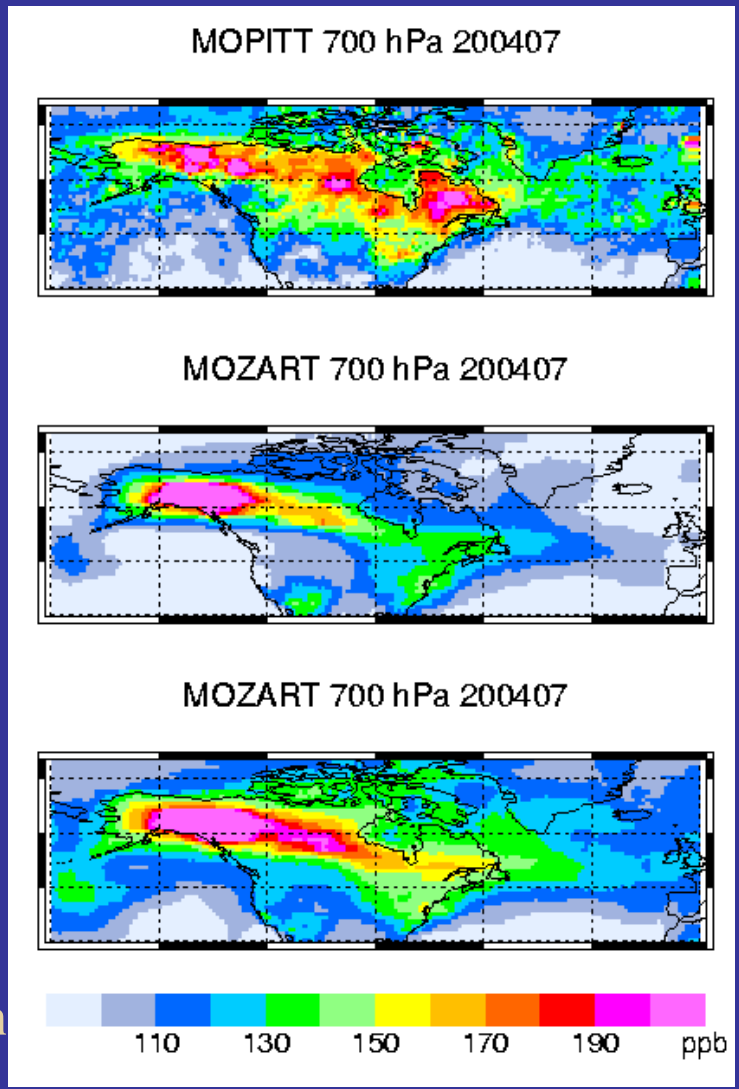
MOPITT Averaging Kernels applied to MOZART

Background CO

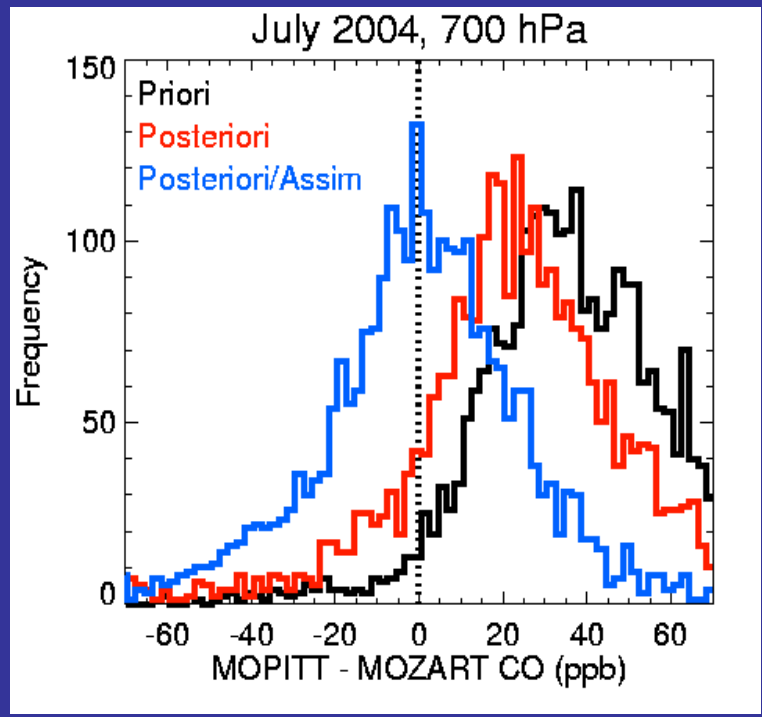
MOPITT

MOZART Posteriori

MOZART Posteriori plus Assimilation

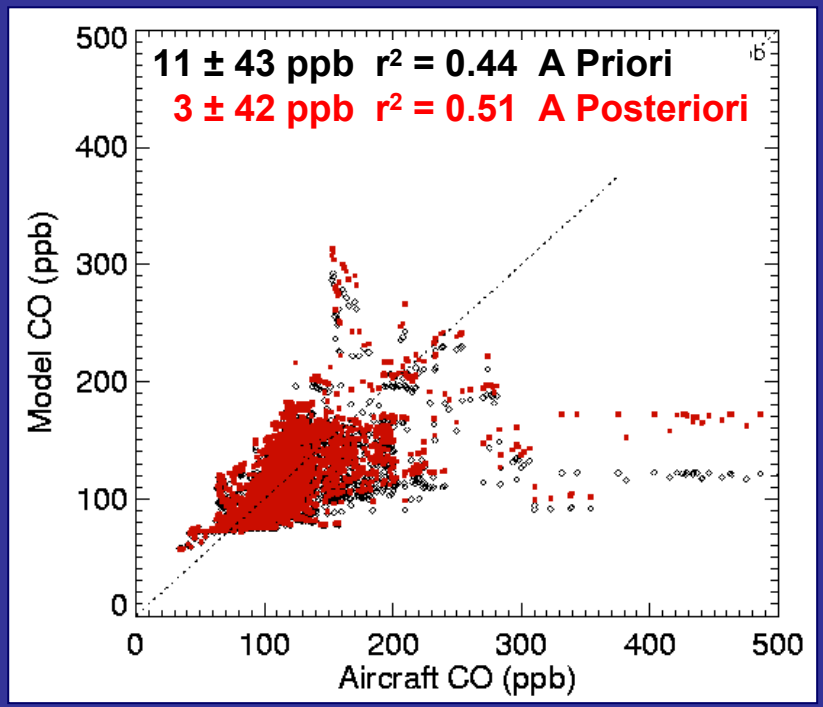


MOPITT *minus* MOZART

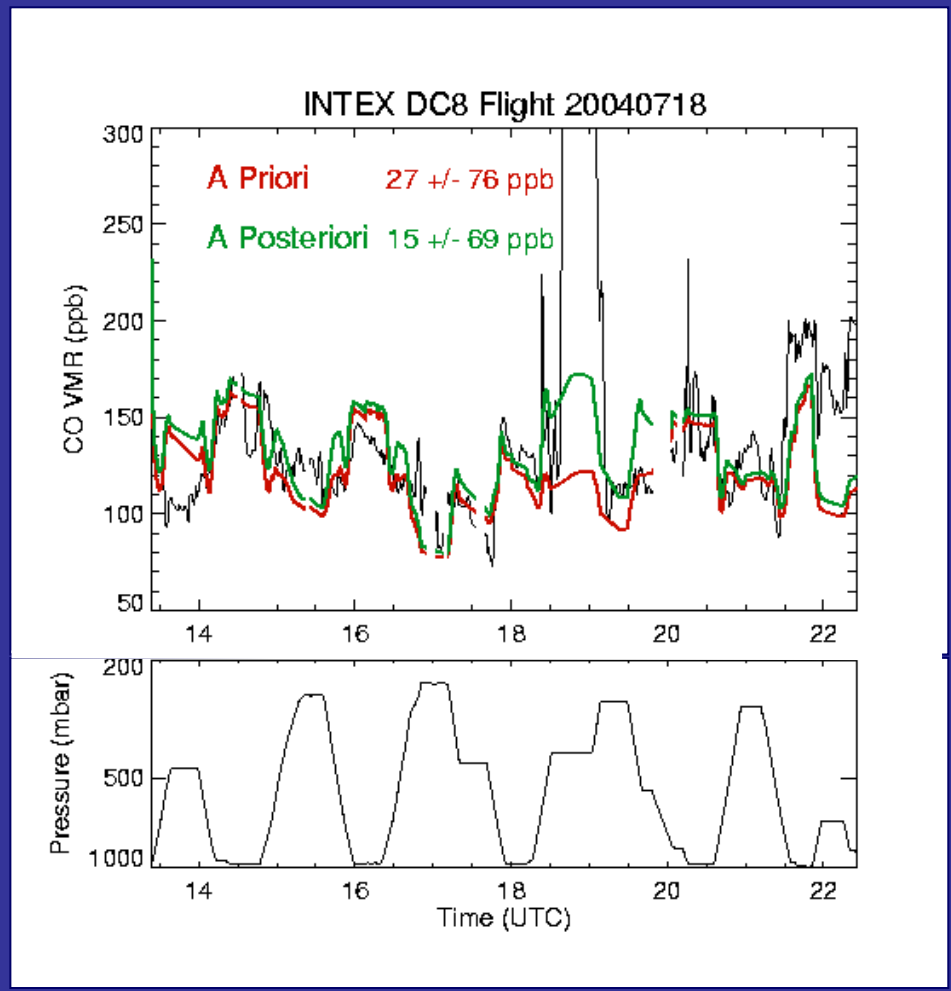


Evaluation with INTEX Data

CO from G. Sachse (DC8)



Flights in New England
July/August 2004



Request for Early Publication

Constraints on Emissions for the Alaskan Wildfires 2004 using Data Assimilation and Inverse Modeling of MOPITT CO

Pfister, G., P.G. Hess, L.K. Emmons, J.-F. Lamarque, C. Wiedinmyer, D.P. Edwards, G. Pétron, J.C. Gille, G.W. Sachse,

for *Geophys. Res. Lett*.

- Primarily a MOPITT inverse modeling study
- MOPITT data is not bound by INTEX data protocol -- they are made public as soon as they are processed
- Results could be useful for on-going INTEX studies

Emissions files will be made available - contact us (pfister@ucar.edu or emmons@ucar.edu)